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A RECORD DROUGHT IN THE FOOTHILLS

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Like much of California's foothill area, the San Joaquin Experimental Range, near O'Neals, Madera County, received abnormally low rainfall during the 1958-59 season. Also, even though the 1959-60 season began with a heavy rain on September 19, 1959, a dry spell the next 96 days extended the effects of drought. Herbage production dropped to a new low. Yet for several reasons cattle made substantial weight gains on the range with relatively light feeding of supplements.

The San Joaquin Experimental Range, including about 4,600 acres at an elevation of 700-1,700 feet in the western Sierra Nevada foothills, is representative of the annual plant type found in the granitic-soil area of the foothills, and to a lesser extent is comparable to several million acres of annual-plant rangeland in California. Some of the problems encountered in conducting rangeland research on the Range are the same ones facing many foothill ranchers.

These problems originate from basic soil, climatic, and vegetative factors such as a shallow soil with low water-holding capacity, definite wet and dry seasons, and annual-type plants that respond readily to fluctuations in moisture and temperature (resulting in distinct forage or feed "seasons"). The widely fluctuating forage supply available from year to year and how to best utilize this resource within the vegetative seasons are ever-present problems. The rancher operating entirely on annual-type foothill range, seeks the most efficient possible use of available forage so he can reduce to a minimum the amount of expensive supplements needed to keep his herd productive. Even the foothill rancher who uses other ranges (mountain range, irrigated pasture, stubble, etc.) for parts of the year must use the annual-type forage on the home ranch efficiently to round out and streamline his cattle operation. Generally speaking the average years or good years do not pose a serious problem; the bad years or drought years on the foothill ranch bring on the headaches--and big feed bills.

Rainfall

Detailed weather records have been kept at the San Joaquin Experimental Range since 1934. The 10.12 inch rainfall for the 1958-1959 season, barely half the 25-year average of 19.53 inches, was the lowest ever recorded (fig. 1). Probably more important, rainfall distribution was very unfavorable; only January and February produced rains spaced favorably for plant growth. From February 23 to April 26, when plants were capable of making maximum growth, only 0.04 inches of rain were recorded. After this dry period, the rain that fell late in April was "too little and too late". It was of little value to the total herbage production because most of the vegetation had already matured or dried.

As far as rainfall records go, the drought of 1958-59 ended when the 1959-60 season began with a record-shattering 3.70 inches of rain on September 19, 1959. This soaking rain brought about extensive germination, and plant growth was good for several weeks. But then much of the new vegetation stopped growth and died during the 96 rainless days following the first storm. No rainfall was recorded in either October or November (another "record") and only 0.36 inches of rain fell in late December. For the last quarter of 1959, rainfall was only 6 percent of normal.

Herbage Production

The effect of the 1958-59 drought year on plant growth was a new low in herbage production:

Year:	Herbage production (Pounds per acre, air-dry)
Average (25 years)	1,650
1951 - highest	2,600
1949 - previous low	1,100
1959 - new low	690

Less than half of an average forage crop was produced in 1959, by far the lowest ever. If the area had been more heavily grazed the previous year, production would surely have been even lower. Relatively light grazing in 1957-58 had left an appreciable amount of litter, or old growth, on the ground. This litter, by providing shelter for the young plants and by reducing evaporation, undoubtedly made possible some "extra" growth during the unfavorable 1958-59 season.

As every foothill rancher well knows, total forage production is not the whole story; the length of time sufficient green feed is available is also important. It is during this season that the largest numbers

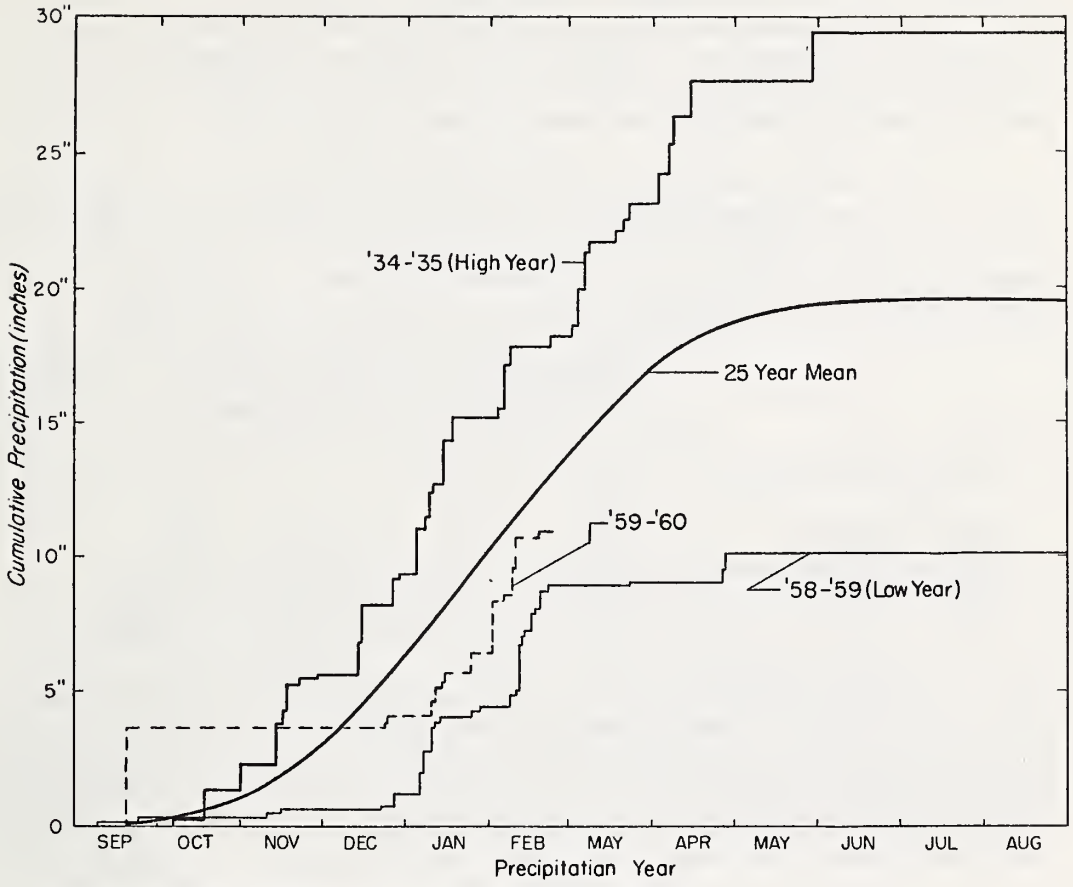

Figure 1. Cumulative precipitation, San Jaaquin Experimental Range.

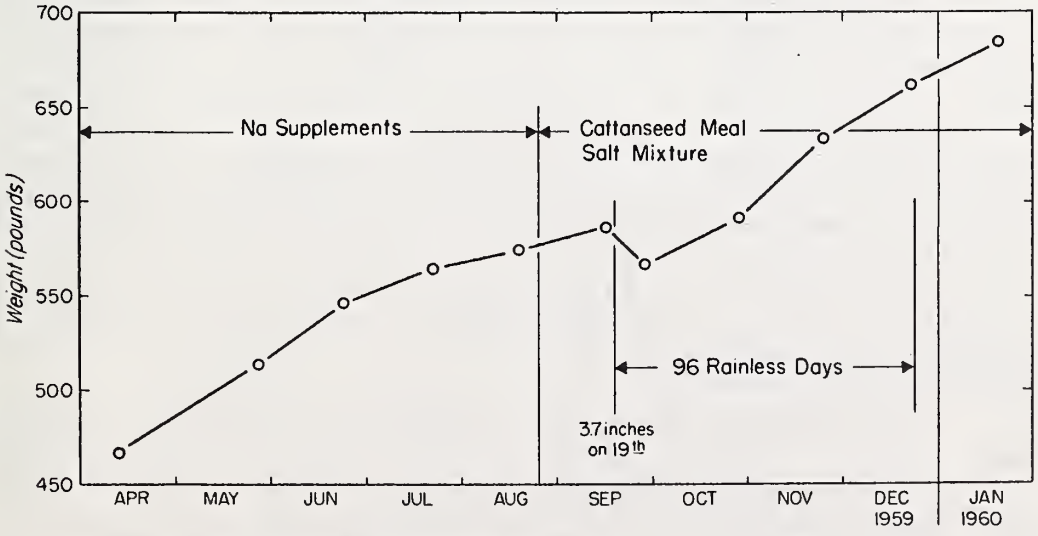

Figure 2. Heifer weights, San Jaaquin Experimental Range.

of cattle are on the foothill ranges, and maximum beef gains are usually made when forage is abundant, attractive to livestock, and high in nutrient content. Also, the earlier adequate green feed is available, the shorter the time that costly concentrates, hay, or both have to be fed during the winter. A drastic shortening of the adequate green season seriously cuts overall beef production.

The average "adequate green season" on the experimental range is from about February 2 to June 10. This is the season when green forage is ample for stocking a given area of rangeland at normal capacity and satisfactory cattle weight gains can be expected without supplements. The length of this season varies a great deal:

Year:	Beginning and ending dates of the adequate green season	Duration in weeks
Average (25 years)	Feb. 2 to June 10	18
1951 - longest	Nov. 2, 1950, to June 5, 1951	31
1944 - shortest	March 7, 1944, to May 16, 1944	10
1959	March 13, 1959, to May 27, 1959	11

Thus, the 1959 adequate green season was the next to the shortest on record and about 7 weeks shorter than in an average year. In reality, the situation was worse than the record showed; the shortage in overall forage quantity brought about by the scanty and poorly distributed rainfall in 1958-59 was made even more acute by the short period that good high-quality green feed was available.

In such periods of very short herbage production, both in quantity and the length of time green feed is available, small areas of higher than average production undoubtedly carry more than their proportional share of grazing pressure. This was especially true of areas under the canopies of the numerous scattered blue oak trees on the experimental range in 1958-59. In most years, early season herbage production is decidedly greater under the canopies of blue oaks than in adjacent or surrounding open areas. By the end of the growing season in more normal years, this difference is less apparent. But under the very dry conditions of 1958-59, areas under the blue oaks definitely produced more total herbage (60 percent more) than open areas. This important difference in production is probably the result of several complex and interacting factors, but two of the main reasons for the 1958-59 results were:

1. Plants under the trees got the usual early "head start," and

2. plants in the open, because of lack of March and April rain, never caught up.

Cattle Performance

The all-time low rainfall and herbage production in 1958-1959 are a matter of record. How did the cattle fare? In April 1959, 99 uniformly good Hereford heifers were received. These heifers are involved in yearlong and varied seasonal grazing trials designed to develop an improved grazing system for annual-type rangeland. High sustained beef production without deterioration of the range resource depends upon efficient, practical grazing management.

The cattle were first put out on the range about a month after range readiness (the beginning of the adequate green season), but already much of the vegetation was mature and dry. Soon afterward the bulk of the important forage plants dried out. So for practical purposes the heifers were primarily on dry native vegetation from mid-April until September 19, when 3.70 inches of rain fell. Despite all-time low herbage production, the heifers did very well on the dry forage that was available.

In the 156 days from April 13 to September 16, the average weight rose from 466.5 to 585.8 pounds (fig. 2). This gain of 119.3 pounds, 0.76 pounds per heifer per day, varied seasonally from slightly over one pound per day in May and June to a low of about one-third pound per day in August. Adequate water and salt were available at all times, and the only supplement used during the 156 days was a small amount of 2:1 and 3:1 cottonseed meal-salt mixture put out in late August. Very little of the meal-salt mixture was consumed (less than a pound per heifer per day), so the supplement had little effect on the overall dry-season gain.

Thus, even though the 1958-59 season produced the lowest herbage yields on record, the forage that was available was evidently of high quality. This is borne out by the fact that cattle gains during the dry season were higher than usually recorded in "good" forage years without supplements. Many foothill ranch operations utilize the home range mostly during the adequate green season and the inadequate green (winter) season. Often, cattle are on other ranges during the dry season. In 1959 yearlong foothill ranchers whose animals grazed similar range during the dry season found the dry feed to be "strong".

Other Effects

Although the cattle gained well on the scanty but "strong" dry forage, the drought severely hindered the start of new long-time research studies. The range units in the new study were necessarily designed with a grazing capacity based on normal herbage production in mind. Since the units produced less than half an average forage crop in 1958-59, the supply became short earlier than would usually be the case. Ordinarily an acre of this foothill range will carry a yearling

heifer for 18 days. This year a safe capacity was about one-third as much--actually less than 7 heifer days per acre. In other words, to maintain the cattle and range in good condition it was necessary by late September to either feed hay or move the animals to units with more available dry forage. The latter practice was followed and a cottonseed meal-salt mixture supplement was used.

Furthermore, stock water became an increasingly serious problem as the drought continued. Many springs dried up early in the year. Some of the better springs had never been known to dry up in past years, and others which usually dried up in the fall were bone-dry by mid-summer. Water had to be hauled to several of the study units over an unusually long period. The heavy rain in September 1959 did very little to ease the water-hauling job. It was still necessary to haul water to some experimental units in January 1960.

During the inadequate green season, or after the heavy rain on September 19 leached out the dry vegetation and started germination of the 1959-60 forage crop, the 99 heifers did well on a cottonseed meal-salt mixture and the available old growth. A weight loss occurred in late September when the animals stopped eating the old growth and began seeking the tiny new green plants (fig. 2). However, when the heifers were moved to a range unit with more old growth available, they went back to grazing the old growth and began taking more of the available cottonseed meal-salt mixture. From September 29 through January 20, a gain of slightly over a pound per heifer per day was made without feeding hay.

The light use of the entire experimental range in 1957-58, a past history of moderate use resulting in good species composition on most of the range, and the relatively light stocking rates in 1958-59 no doubt all had a part in making possible such substantial and economical gains during a very unfavorable drought period.

Summary

In summary, the 1958-59 season produced the lowest rainfall and lowest herbage production ever recorded at the San Joaquin Experimental Range. Although the supply was short, the dry forage utilized by the experimental herd was evidently of good quality, as reflected by an average daily gain of more than three-fourths pound per yearling heifer during the 156 days on dry forage with very little green herbage and range supplements. From late September 1959 to January 20, 1960, the heifers gained slightly more than a pound per head per day on primarily old growth herbage and a cottonseed meal-salt supplement. The extremely dry last quarter of 1959 caused death of a large number of newly germinated plants, and only time will tell the ultimate effect of this adverse period on the coming 1959-60 forage crop.

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